

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appln. No: 10/516,438
Applicant: Kassim Juma
Filed: November 30, 2004
Title: FILTER DEVICE FOR MOLTEN STEEL FILTRATION
T.C./A.U.: 1797
Examiner: Benjamin M. Kurtz
Confirmation No.: 5503
Docket No.: SUD-104US

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF DR. KASSIM JUMA PURSUANT TO 37 CFR §1.132

I, Kassim Juma, hereby swear and state that:

1. All statements herein made of my knowledge are true and statements made on information and belief are believed to be true.
2. I have been active in research and development in the fields of ceramics and/or metals for the last 30 years.
3. I received a Ph.D. degree in Ceramics from Sheffield University, which is located in Sheffield in the United Kingdom.
4. I am the author of 20 papers in the field of ceramics and/or metals
5. I am listed as an inventor on 31 US patents and foreign patents, particularly relating to products and methods related to ceramics, metals and their processing.
6. I am very familiar with refractory filters as used in the casting of molten metals.
7. I have carried out and supervised numerous experimental and commercial trials concerning refractory filters.

8. I am the inventor of the subject matter described in the present application, U.S. Patent Application No. 10/516,438 ("the '438 application"), which was published as U.S. Patent Publication No 2005/0263449.
9. I have read and am familiar with the contents of this patent application and the Office Action dated September 21, 2009. I understand the nature of the obviousness rejections at issue in this application. In particular, the Office relies on U.S. Patent No. 5,520,823 (Jones) for allegedly teaching a filter comprising a carbon bonded network of graphitized carbon, the graphitized carbon being present in an amount up to 15 % by weight, and on U.S. Publication No. 2007/0090047 (Bell) for allegedly also teaching the graphitized carbon constituting the bonded network being present in an amount up to 15 % by weight.
10. The filter as described in the '438 application and defined in claim 12 is made of a ceramic material comprising ceramic particles that are bound by a carbon bonded network of graphitized carbon. The carbon bonded network of graphitized carbon is reinforced by addition of fibers. The carbon bonded network forms a continuous matrix in which the particles of the ceramic phase and the fibers are embedded. The carbon bonded network of graphitized carbon is present in an amount up to 15 % by weight of the filter. The filter device withstands high temperatures of more than 1400 °C and therefore may be used for molten steel filtration
11. I have read and reviewed U.S. Patent No. 5,520,823 to Jones, and have found that the product described therein differs from the product of the present invention.
12. The filter described by Jones is for filtering molten light metals, e.g. aluminum, magnesium and alloys of these two metals as is described in the first paragraph of column 1 of the Jones reference. The borosilicate glass used to produce the filters has a softening temperature (T_1) in the range of 600 °C, more preferably 650 °C to 900 °C and a melting temperature (T_2) in the range of 700 °C to 1100 °C as is explained in column 2, lines 38 to 42. Aluminum has a melting temperature of 660 °C and magnesium has a melting temperature of 650 °C. Casting of these metals is performed at temperatures of below about 800 °C. The casting temperature of light metals is much lower than the

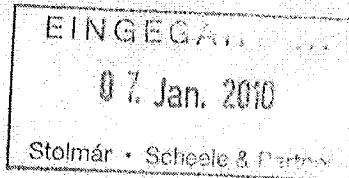
temperature used in steel casting. The filter described by Jones is not suitable for steel casting due to the use of borosilicate glass as a binder.

13. The filter described by Jones comprises ceramic particles, graphite, wollastonite and silica that are bound by a substantially amorphous matrix of borosilicate glass (see abstract). According to column 2, lines 28 to 31, the aqueous slurry used for producing the filters comprises 35 – 50 % by weight of borosilicate glass. In the table of example 1, an amount of 32,82 % borosilicate glass is mentioned. The amount of borosilicate glass in the slurry corresponds approximately to the amount of ceramic particles. In the final filter the borosilicate glass therefore unavoidably forms a continuous matrix.
14. In column 3, lines 13 to 16 is mentioned, that in addition to graphite the composition which is used to produce the filter may also contain amorphous carbon, such as carbon black, usually in an amount of up to about 5 % by weight. In the table of example 1 an amount of 1.82 % amorphous carbon contained in the slurry is mentioned. Amounts of 1.64 % and 1.59 % are mentioned in examples 2 and 3, respectively. The amorphous carbon is added to improve the rheology of the slurry and losing of the strand of the reticular organic foam during impregnation of the foam with the slurry. The amount of amorphous carbon contained in the slurry is very low compared to the amount of borosilicate glass.
15. During firing of the filter most of the amorphous carbon will be burnt off. However, even if some small amount of the amorphous carbon will be graphitized and will remain in the filter after firing, such graphitized carbon will not form a continuous matrix, i.e. a carbon bonded network of graphitized carbon, due to the large excess of borosilicate glass present in the filter. In the filter according to Jones, the network, or in other words the matrix, is formed by borosilicate glass. The filter described by Jones does not comprise a carbon bonded network of graphitized carbon but instead comprises a matrix of amorphous of borosilicate glass with crystalline particles of graphite dispersed therein. Every graphitized carbon formed from amorphous carbon, if at all present, is provided in isolated domains dispersed in the continuous matrix of borosilicate glass.

16. I further have read and reviewed U.S. Patent Application No. 2007/0090047 A1 to Bell, which is a continuation of application No. 10/362,751, now U.S. Patent 7,138,084, and have found that the product described therein differs from the product of the present invention.
17. Bell describes a filter comprising particles of refractory material embedded in and bonded together by a carbon matrix material. However, to obtain sufficient stability during metal casting, a high amount of carbon matrix bonding material of at least 25 wt.% is required.
18. In paragraph [0039] is described by Bell that the relative proportions (in percentage by weight) of the particulate refractory material to binder are preferably in the range at least 50 % refractory : no more than 50 % binder; more preferably they are in the range at least 55 % refractory : no more than 45 % binder; even more preferably they are in the range at least 60 % refractory : no more than 40 % binder, for example approximately 65 – 75 % refractory : approximately 35 – 25 % binder.
19. The filter described by Bell contains at least 25 weight % binder. This is obvious to me also from the examples. In example 2, paragraph [0104], 40 wt.% of nitric acid treated Rauxolit FF and 60 wt.% graphite are used for the manufacturing of the filter. In example 3, paragraph [0106], 30 % by weight of nitric acid treated Rauxolit FF and 70 % by weight of refractory material (alumina powder and graphite) are used for the manufacturing of the filter. The other components added to the slurry (water, organic binder, thickener and suspension agent) will be volatilized during firing such that relative amount of Rauxolit and refractory corresponds approximately to the percentage of bonding material and refractive material present in the filter. The filter of example 2 contains 40 % weight binder and the filter of example 3 contains 30 % weight binder. The filter of example 2 as well as of example 3 both contain unavoidably more than 25 weight % binder.
20. In paragraph [0046], second line, Bell explains that it is preferred to use a binder containing from 0 to 50 weight %, preferably 0 to 20 wt % (based on the total binder) of mesophase in the process for making the filter material. It is further explained, that the

bonding of the refractory particles is preferably achieved with the carbon matrix in the form of semicoke. The semicoke is preferably formed by heating coal tar or pitches, petroleum tar or pitches or synthetic aromatic polymer to cause the formation or at least some so-called "mesophase". The liquid or semi-liquid mesophase coats the surface of the refractory particles, and the mesophase is then converted on firing to form the carbon matrix of semicoke.

21. In paragraph [0043] Bell teaches that during the firing of the filter, it is preferred that the binder already contains and/or develops a quantity of mesophase in the range 5 to 60 %, for example 10 to 50 %, more preferably 15 to 45 % for example 20 to 45 % on the weight of the binder.
22. In the formation of a carbon matrix of semicoke "mesophase" is a component that is only formed as an intermediate. Further, only part of the carbon-rich binder is transformed into "mesophase". The "mesophase" is then further converted to form together with other components of the carbon rich binder a binder matrix for binding together the refractory particles. The proportion of "mesophase" formed during firing of the filter is not equivalent to the amount of the carbon bonded network of graphitized carbon present in the final filter.
23. An amount of 25 wt% binder that contains 20 wt% to 25 wt% mesophase corresponding to about 5 wt% mesophase in the filter does not correspond to an amount of about 5 wt% of carbon bonded network of graphitized carbon but to an amount of about 25 wt% carbon bonded network of graphitized carbon based on the weight of the filter.
24. Bell states in paragraph [0041] "... a solid mesophase or "semicoke" is formed. This is the bonding phase, i.e. carbon bond in the refractory system". Bell also states in paragraph [0046] "The semicoke is preferably formed by heating coal tar or pitches, petroleum tar or pitches or synthetic aromatic polymer to cause the formation of at least some so-called "mesophase". The semi-liquid mesophase is then converted on firing to form the carbon matrix of semicoke".



25. Bell explains in lines 16 to 19 of paragraph [0041] that both coal tar and petroleum pitches produce mesophase, the amount produced being primarily dependent upon the aromatic content of the starting material. This means that the carbon-rich binder is not transformed completely to "mesophase". Therefore, "semicoke" does not only comprise the graphitized carbon formed from "mesophase" but also other carbon-rich materials comprised in the starting binder material but not transformed into mesophase during firing. "Mesophase" is not equivalent to the term "graphitizable carbon precursor" as used in the claims. The term "graphitizable carbon precursor" as used in the claims is equivalent to the term "binder" as used by Bell, i.e. the carbon-rich starting binder material which in part is transformed to "mesophase" upon firing.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the above-referenced application or any patent issuing thereon.

Date

5/1/2010

Kassim Juma

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